IN THE CLAIMS:

Please amend claims 1, 16, 18, and 21, as follows:

1. A plasma treatment apparatus, comprising:

at least first and second cathodes separated by a gap, said first cathode comprising a first exposed cathode surface and a first magnetic polarity, said second cathode comprising a second exposed cathode surface and a second magnetic polarity, and said first exposed cathode surface oriented non-parallel to said second exposed cathode surface;

A1 a set of magnets operative to generate a magnetic field exiting from one of the cathodes and entering the other of the cathodes, thereby crossing the gap;

said magnetic field comprising a first magnetic field portion crossing the gap and passing through said first exposed cathode surface, said first magnetic field portion comprising magnetic field lines having a maximum field strength of at least 100 Gauss;

at least one anode structure positioned to create an electric field extending from the cathodes to the anode structure, at least a portion of said electric field crossing said magnetic field and forming a closed-loop electron containment region within said magnetic field, a sufficient voltage between the anode structure and the cathodes operative to form a plasma within the magnetic field when a gas is present near the containment region at a gas pressure between 0.1 and 100 mTorr; and

at least one substrate positioned to be treated by said plasma.

A2 7. The apparatus of claim 6 wherein at least one of the cathodes comprises a facing cathode surface having a shape selected from the group consisting of: a point, a bevel, a rounded surface, a stepped surface, a ridged surface, and combinations thereof.

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16. A plasma treatment apparatus, comprising:

at least first and second cathodes separated by a gap, said first cathode comprising a first magnetic polarity, and said second cathode comprising a second magnetic polarity;

a set of magnets operative to generate a magnetic field exiting from one of the cathodes and entering the other of the cathodes, thereby crossing the gap;

A3 at least one anode structure positioned to create an electric field extending from the cathodes to the anode structure, at least a portion of said electric field crossing said magnetic field and forming a closed-loop electron containment region within said magnetic field, a sufficient voltage between the anode structure and the cathodes operative to form a plasma within the magnetic field when a gas is present near the containment region at a gas pressure between 0.1 and 100 mTorr; and at least one substrate positioned to be treated by said plasma;

wherein the magnetic field is asymmetrical with respect to a central axis of the gap extending between the cathodes, and wherein the electron containment region extends farther away from the central axis on one side of the gap than on the other side of the gap.

18. A plasma treatment apparatus, comprising:

A4 at least first and second cathodes separated by a gap, said first cathode comprising a first magnetic polarity, and said second cathode comprising a second magnetic polarity;

a set of magnets operative to generate a magnetic field exiting from one of the cathodes and entering the other of the cathodes, thereby crossing the gap;

at least one anode structure positioned to create an electric field extending from the cathodes to the anode structure, at least a portion of said electric field crossing said magnetic field and forming a closed-loop electron containment region within said magnetic field, a

sufficient voltage between the anode structure and the cathodes operative to form a plasma within the magnetic field when a gas is present near the containment region at a gas pressure between 0.1 and 100 mTorr; at least one substrate positioned to be treated by said plasma; and

a set of ferromagnetic elements magnetically coupled to the set of magnets to provide a ferromagnetic return magnetic path, thereby enhancing the magnetic field across the gap.

21. A plasma treatment apparatus, comprising:

at least first and second cathodes separated by a gap, said first cathode comprising a first magnetic polarity, and said second cathode comprising a second magnetic polarity;

a set of magnets operative to generate a magnetic field exiting from one of the cathodes and entering the other of the cathodes, thereby crossing the gap;

at least one anode structure positioned to create an electric field extending from the cathodes to the anode structure, at least a portion of said electric field crossing said magnetic field and forming a closed-loop electron containment region within said magnetic field, a sufficient voltage between the anode structure and the cathodes operative to form a plasma within the magnetic field when a gas is present near the containment region at a gas pressure between 0.1 and 100 mTorr;

at least one substrate positioned to be treated by said plasma;

an enclosure extending from the cathodes around a portion of the electron containment region positioned away from the substrate; and

a source of process gas positioned within the enclosure.

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